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REPORT ON THE FAO/MARMAP INTERNATIONAL TRAINING COURSE ON FISH EGG AND LARVAL STUDIES

La Jolla, California, 2-29 September 1973

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 1974

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Rome, March 1974

PREPARATION OF THIS REPORT

This document is the report of the FAO/MARMAP International Training Course on Fish Egg and Larval Studies (La Jolla, California, 2-29 September 1973), jointly organized by FAO and the Marine Resources Monitoring, Assessment and Prediction Programme (MARMAP) of the U.S. National Marine Fisheries Service, with the collaboration of Unesco. The report, prepared in English only, will be given a limited distribution.

On the basis of the experience gained during the Course on fish egg and larval studies for resources evaluation purposes, the FAO document "Fish Egg and Larval Surveys (Contribution to a Manual)" (FAO Fish.Tech.Pap., No. 122), used as training material, will be revised and issued in the FAO Manuals in Fishery Science series during 1974.

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CONTENTS

		Page
	ABSTRACT	v
1.	INTRODUCTION	1
	1.1 Background	1
	1.2 Organization of the Course	2
	1.3 Participants	2
2.	CONDUCT OF THE COURSE	2
3.	SUMMARY OF LECTURES AND DISCUSSIONS	3
	3.1 Ichthyoplankton Studies for Resources Evaluation	3
	3.2 Identification of Fish Eggs and Larvae	3
4.	CONCLUSIONS	4
APPENDIXES		5
	1. List of participants and training staff	5
	2. Day-to-day programme	7
	3. Facilities available for practical work	12
	4. List of instruction material provided to each trainee	13
	5. Excursions and other group activities	17
	6. Example of original illustrations provided for practical work on identification	18

ABSTRACT

A total of 20 participants from the following 12 countries received training: Chile (3), Colombia (1), Finland (1), Indonesia (1), Italy (1), Japan (1), Mexico (3), Panama (1), Peru (1), Spain (1), Thailand (1), U.S.A. (5). The training consisted of four weeks of lectures and practical work in the laboratory. During two days the participants also received practical training at sea on quantitative ichthyoplankton sampling with standard gear on board the R/V DAVID STARR JORDAN. The training included two main sections: (a) ichthyoplankton studies for resources evaluation purposes and (b) identification of early life stages of fish of commercially important species.

The objective of fish egg and larval surveys was emphasized in relation to fisheries science and the importance and limitations of these studies as an independent method for resources estimation were discussed in relation to other methods.

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1. INTRODUCTION

1.1 Background

Ichthyoplankton research has played an important role in marine science and its applications to fisheries since the end of the last century. It has contributed not only to the clarification of basic problems of fish taxonomy, ecology and zoogeography, and to the knowledge of the life history of commercially important fish species, but also to the exploration of fishery resources, a better understanding of their behaviour and the study of fish population dynamics. In a general sense, the fishery-oriented targets of ichthyoplankton surveys which are considered of particular value, include exploration for potential fishery resources, location of spawning concentrations of fish stocks, evaluation of relative abundance of such stocks (mainly in little known areas)and monitoring of long-term changes in the composition and abundance of resources and in spawning times and areas. In a more restrictive sense, specifically in the case of fish stocks whose spawning activities can be fully covered in time and space by ichthyoplankton surveys, the targets of this type of research may be even more ambitious: tracing of fluctuations in spawning stocks by estimating the abundance of their eggs and young larvae, forecasting year-class strength on the basis of the abundance of older larvae, estimating abundance of a stock based on its spawning population, and discriminating between stocks of the same species. In this context, ichthyoplankton surveys are used as a fisheries-independent method of estimating fish stock abundance, complementary to other methods of resources evaluation.

Having in mind these fishery-oriented objectives, FAO has promoted, as part of its field programmes, in certain cases fish egg and larval studies, especially in some Latin American and West African areas.

Following a recommendation by its Advisory Committee for Marine Resources Research (ACMRR), FAO has also convened a Working Party on Fish Egg and Larval Surveys whose terms of reference were, among others, to assess the potentialities and limitations of egg and larval surveys in comparison with other methods of exploration and stock assessment and also to advise on the best choice of gears and their appropriate operation for quantitative sampling with a view to promoting their standardization and hence to improving the comparability of quantitative results in the future. One of the first practical results of the Working Party's activities was in fact FAO's attempt to standardize the ichthyoplankton sampling gear used in various field projects operated by the Organization. Another outcome has been the preparation of the document "Fish Egg and Larval Surveys (Contributions to a Manual)" (FAO Fish.Tech.Pap. No. 122) which was used as teaching material during the course.

Considerable progress has been made during recent years in the methodology and technology of ichthyoplankton surveys. However, much can still be done to improve their usefulness for reaching the described fishery-oriented objectives. Ichthyoplankton work is all too often considered merely as a byproduct of oceanographic or fisheries surveys. Other problems are lack of target-oriented planning, shortcomings of sampling gear and techniques (there is hardly a field with a larger variety of sampling techniques) and lack of well trained personnel and adequate means to evaluate the results of such surveys. It is for these reasons that fishery-oriented training in fish egg and larval surveys is a very important element for improving the contribution from this field to fisheries research as a whole.

Vast practical experience, particularly in the development of more effective quantitative sampling gear, has been acquired recently during the U.S. National Ichthyoplankton Project launched some years ago by the National Marine Fisheries Service (NMFS) as part of the U.S. Marine Resources Monitoring, Assessment and Prediction Programme (MARMAP). It was, therefore, very fortunate that through collaboration between FAO and the authorities in the U.S.A., this course could be organized, and it is hoped that other similar exercises could follow some time in the future.

1.2 Organization of the Course

The Course which was held from 3 to 28 September 1973 at the Southwest Fisheries Center (SWFC) in La Jolla, California, was organized jointly through collaboration between the U.S. National Marine Fisheries Service and FAO. The Center as the host institution was responsible for all local arrangements, including provision of lecturers, laboratory space and vessel facilities required for the Course. FAO was responsible for the international arrangements, such as participation of trainees, etc., and provided an officer from Headquarters in Rome to assist in the organization and conduct of the Course. The participation of trainees from developing countries was sponsored by various FAO/UNDP field projects. The UN Educational and Scientific Organization (Unesco) provided valuable assistance through fellowship funds for the participation of trainees from other developing countries and facilitated also the communication with various scientific institutions and potential candidates.

The choice of the SWFC as the host institution for the Course proved to be an excellent one. The Center doubtless has long experience in the field of ichthyoplankton surveys oriented toward fishery resources evaluation and monitoring, resulting mainly from its ichthyoplankton survey programme in the region of the California Current carried out regularly over a period of more than 25 years. The Center also has the world's largest reference collection of full series of developmental stages of commercially important fish species.

Although the Course was intended primarily for trainees from countries eligible for technical assistance according to FAO standards, other interested countries were invited to sponsor the attendance of research workers at their national expense.

The responsibilities for the conduct of the Course were allocated as follows:

- Director: Dr. E.H. Ahlstrom (SWFC)
- Co-Directors: Dr. P. Smith (SWFC)
  Dr. E. Fagetti (FAO)

A list of the Lecturers and Technical and Secretarial Assistance is included in Appendix 1.

1.3 Participants

The Course was attended by 20 trainees from the following nations: Chile (3), Colombia (1), Finland (1), Indonesia (1), Italy (1), Japan (1), Mexico (3), Panama (1), Peru (1), Spain (1), Thailand (1) and U.S.A. (5) (see Appendix 1).

Most of the participants had already been actively engaged in ichthyoplankton research within their countries and were, therefore, in a position to contribute in a very productive way to the discussions during the Course.

2. CONDUCT OF THE COURSE

The training consisted of four weeks of mixed lectures and practical work on (a) identification of fish eggs and larvae and (b) ichthyoplankton studies for resources evaluation purposes. The participants were split up into two teams for alternate 9 days training on identification and sampling, in order to facilitate individual tuition during the practical work. The trainees selected at international level participated in and completed both parts of the Training Course, whereas the participants from the U.S.A. and those from other countries studying in American Universities, joined either part of the Course according to their personal interest (see Appendix 1). From 22 to 23 September the participants also received practical training at sea aboard the R/V DAVID STARR JORDAN.

Details of the day-to-day conduct of the Course are given in Appendix 2. The facilities available and the background material and literature provided to each of the trainees are listed in Appendixes 3 and 4.

The lectures and practical work on identification were based on fish reference collections of 96 life history series and related instruction material prepared for this purpose by staff of the SWFC. The lectures for resource evaluation sampling were based in part on the Monography on Zooplankton Sampling and on the FAO document "Fish Eggs and Larval Surveys (Contributions to a Manual)" (FAO Fish.Tech.Pap. No. 122). On the basis of the experience gained during the Course, the latter publication will be revised and completed with a view to producing a final version of the Manual to be published during 1974.

3. SUMMARY OF LECTURES AND DISCUSSIONS

3.1 Ichthyoplankton Studies for Resources Evaluation

During the theoretical training of this part of the Course the objectives of fish egg and larval studies were discussed in relation to fisheries research and management. A comprehensive review of sampling strategy and methods for fish egg and larval estimation as well as other biological and environmental data needed for resources evaluation and monitoring purposes was presented. The theoretical training covered essentially the following topics:

(a) planning and conducting ichthyoplankton surveys for regional annual estimate of fish eggs and larvae and its conversion into estimate of spawning biomass;

(b) basic statistics necessary to achieve the estimate of spawning biomass, as e.g., correlation coefficient used to evaluate regression, etc.;

(c) artificial rearing of fish eggs and larvae under controlled conditions for identification purposes as well as for determination of temperature and other environmental effects on rate of development;

(d) review of the results achieved by ichthyoplankton surveys carried out off the southern continents mainly in the framework of UNDP/FAO fisheries survey and development projects.

In addition, the trainees were given the opportunity to report on their parental institutions and ichthyoplankton research projects of their home countries.

During the practical work the participants were trained in:

(i) seagoing operations for quantitative sampling of fish eggs and larvae with standard gears;

(ii) volumetric determination of plankton samples and sorting of fish eggs and larvae;

(iii) standardizing and processing fish egg and larval data for annual regional estimates of spawning biomass;

(iv) experimental work on effect of temperature on hatching time.

3.2 Identification of Fish Eggs and Larvae

The basic study material consisted of preserved life history series of identified fish specimens. About one fifth of the series were based on specimens reared in the laboratory, the remainder on material collected during ichthyoplankton surveys. Eggs were included for about half the series.

In addition to the study collection of specimens, the following aids were supplied:

(i) detailed tables with meristic counts relating to the species under study each day, including the number of vertebrae and fin rays and spines for all fins. One purpose of this kind of tabulation was to emphasize the importance of meristic characters in fish larvae identification and in establishing life history series. Not all the data included in these tabulations are available from literature and many of them were obtained by making original counts;

(ii) a bibliography including 124 titles referred to during the Course;

(iii) illustrations for 84 of the 96 life history series studied during the Course. In all, 126 pages of illustrations were given to each participant, of which 25 were based on original, unpublished drawings (see Appendix 6).

During the 8 days of practical work in the laboratory each trainee had the opportunity to study 12 life history series per day (total of 96 life histories). Emphasis was placed on carrying life history series to the species level, and 89 series were at this level, 4 to the generic level and 3 to the family level. For the 3 series carried to the family level, 3 kinds of larvae were included in each series.

The study of life history stages concentrated on fishes of commercial importance. The material included fishes from both the eastern North Pacific and western North Atlantic.

4. CONCLUSIONS

Twenty participants from 12 countries received a thorough training in planning and conducting ichthyoplankton studies for resources evaluation purposes. In the theoretical part of the Course, the fishery-related objectives of these studies were analysed and an attempt was made to identify precisely the kinds of data required for the implementation of specific targets aimed at fishery resources evaluation by means of ichthyoplankton surveys.

In the course of the practical work, participants were trained in quantitative sampling at sea and handling and processing of ichthyoplankton samples and data in the laboratory.

Excellent working facilities were available to the Course at the Southwest Fisheries Center, including experimental aquaria, a research vessel, a unique collection of classified fish eggs and larvae material (covering more than 400 larval series of fish species)collected in different world areas, and a very extensive bibliographic reference collection. The Course also benefited from the outstanding work achieved by a highly experienced team of lecturers and technical and administrative assistants who worked full-time throughout the period of the Course.

Most of the trainees had already been actively engaged in ichthyoplankton research prior to the Course and all of them appear to have greatly benefited from this opportunity for specialized training.

In filling in their evaluation forms, trainees commented quite positively on the conduct and the results of the Course. They recommended that FAO should continue to mobilize international funds for the organization of similar courses in this field in the future. They further suggested that participants continuing to work on problems of fish eggs and larvae identification in their home countries should be given, after some time, an opportunity to visit the SWFC once more for a period of 6 weeks to 3 months for the purpose of studying their own material under the guidance of Dr. Ahlstrom and other staff of the Center.

Appendix 1

LIST OF PARTICIPANTS AND TRAINING STAFF

Trainees

CEBALLOS, Sonia, Mrs. (Panama)
Scripps Institution of Oceanography
La Jolla, California
U.S.A.

CORTES, Patricio L., Mr.
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PERU

VATANACHAI, Sa-Nga, Mr.
Marine Fisheries Laboratory
Department of Fisheries
Bangkok
THAILAND

TRAINEES IN PART OF THE COURSE

1. Training in identification

MACLEAN, April, Miss
School of Oceanography
Oregon State University
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TRINAST, Beth Michele, Miss
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WHITE, Wayne, S., Mr.
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2. Training in resource evaluation

ANTEZANA, Tarsicio, Mr.
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RICHARDSON, Sally L., Dr.
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TRAINING STAFF

Director

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Dr. Elda Fagetti
Fishery Resources Division
FAO, Rome, Italy

Lecturers:

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Dr. Tim D. Smith
Southwest Fisheries Center
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Mr. James R. Thrailkill
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Technical Assistants:

Patricia Arasmith, Biological Aid

Mrs. Esther Barker, Statistical Clerk

Mrs. Elaine Sandknop, Biological Technician

Mrs. Elizabeth G. Stevens, Biological Technician

Marine Supervisor:

Lloyd Farrar

Administrative Assistants:

Lillian Vlymen

Patricia Lowery

Photographer:

Kenneth Raymond

Appendix 2

DAY-TO-DAY PROGRAMME

3 September

Opening of the Course

- Welcoming address and information on the programme of the Course and local arrangements by Drs. E.H. Ahlstrom, Director and P. Smith, Co-Director
- Introductory address by Dr. E. Fagetti, FAO Co-Director
- Welcoming address and information on the organization and activities of the U.S. National Marine Fisheries Service by Dr. R. Lasker
- Afternoon free

Course divided into two sections, one group to spend the first two weeks in training on "Ichthyoplankton studies for resources evaluation", the other in "Training on Identification" with the two groups switching courses at mid-term.

I. Training on ichthyoplankton studies for resources evaluation

4 September and 17 September (Day 1)

Theoretical:	Introductory Lecture	P. SMITH
	Objectives of fish egg and larval surveys in relation to fisheries management; Course review	
	Survey planning for spawning biomass estimate	P. SMITH
Practical:	Introduction to the background documents and literature available for the Course	

5 September and 18 September (Day 2)

Theoretical:	Distribution sampling	P. SMITH
	(a) Geographical, vertical and seasonal distribution	
	(b) Oceanic transport and diffusion	
Practical:	Exercises on determination of	J. THRAILKILL
	(a) Horizontal spawning distribution and	
	(b) seasonal spawning cycles based on population data available for anchovy and Pacific hake	

6 September and 19 September (Day 3)

Theoretical:	Volumetric sampling	P. SMITH
	(a) Biases in relation to avoidance, extrusion, escapement, etc.	
	(b) Intercomparison of different sampling gears	

Collecting and processing ichthyoplankton data — J. THRAILKILL

(a) Plankton tows data sheet

(b) Calibration of flow meter

Practical: Exercises on determination of — J. THRAILKILL

(a) Calibration factor

(b) Plankton volume determination and sorting plankters

7 September and 20 September (Day 4)

Theoretical: Microdistribution sampling — P. SMITH

(a) Definition of precision

(b) Scale of patch sizes

(c) Intensity of patterns

Practical: Calculation of standard haul factor for determination of water strained and standard number of larvae under m^2 of surface unit — J. THRAILKILL

8 September and 15 September
9 September, 16 September and 23 September } Weekends FREE

10 September and 25 September (Day 5)

Theoretical: Rearing of fish larvae under controlled conditions — R. LASKER

(a) Induction of spawning in the laboratory

(b) Effect of temperature on rate of development and hatching time

Practical: Experiments on the effect of 8 different temperatures ($12-22^{\circ}C$) on hatching time and determination of Q_{10} (increase of metabolic rate) based on the data obtained in 8 experiments conducted by the trainees

11 September and 25 September (Day 6)

Theoretical: Basic statistics — TIM SMITH

(a) Terminology review

(b) Regression line, standard deviation, standard error

(c) Correlation coefficient

Practical: Practical exercises on the above topics

12 September and 26 September (Day 7)

Theoretical: International cooperation for the development of fisheries sciences — E. FAGETTI

(a) General review of ichthyoplankton surveys conducted off the southern continental coasts under UNDP/FAO Projects

(b) Marine Sorting Center

- Information on parental institutions by trainees and discussion of their research projects
- Visit to the aquarium at Scripps Institution of Oceanography

13 September and 27 September (Day 8)

Theoretical: Spawning biomass estimation — P. SMITH

(a) Seasonal and annual census estimate

(b) Annual fecundity and partial spawning

(c) Conversion of data from eggs and/or larvae census to resources estimate

Practical: Completion of previous exercises on the above topics — J. THRAILKILL

14 September and 28 September (Day 9)

Theoretical: Course review — P. SMITH

Practical: Practical examination and general review of practical exercises — J. THRAILKILL

II. Training on Identification

4 September and 17 September (Day 1)

Theoretical: — E.H. AHLSTROM

(a) Basic methods for establishing life history series of fishes

(b) Distinctive characters for identification of eggs and/or larvae of: Clupeidae, Engraulidae, Elopidae, Albulidae, Argentinidae, Bathylagidae, Gonostomatidae

Practical: Analysis of the larval series of 12 species belonging to the above families

5 September and 18 September (Day 2)

Theoretical: (a) Main characters for identification of pelagic fish eggs — E.H. AHLSTROM

(b) Distinctive characters for identification of eggs and/or larvae of: Gadidae, Bregmacerotidae, Moridae, Macrouridae, Ophidiidae, Scomberosocidae

Practical: Analysis of the larval series of 12 species belonging to the above families

6 September and 19 September (Day 3)

Theoretical: E.H. AHLSTROM

(a) Importance of caudal fin and supporting bones in identification of fish larvae particularly its value in identification of flatfishes

(b) Distinctive characters for identification of eggs and/or larvae of flatfishes: Scophthalmidae, Bothidae, Pleuronectidae, Cynoglossidae, Soleidae

Practical: Analysis of the larval series of 12 species belonging to the above families

7 September and 20 September (Day 4)

Theoretical: Distinctive characters for identification of eggs and/or larvae of: Scombridae, Gempylidae, Trichiuridae, Istiophoridae E.H. AHLSTROM

Practical: Analysis of the larval series of 12 species belonging to the above families

21 September and 22 September

Training at sea on board the R/V DAVID STARR JORDAN on quantitative ichthyoplankton sampling methods with different gears and on observation of environmental features

10 September and 24 September (Day 5)

Theoretical: Review of taxonomy and geographic distribution of the adults of Scorpaeniformes and distinctive characters for identification of the larvae of: Scorpaenidae, Cottidae, Triglidae and Anoplopmatidae E.H. AHLSTROM

Practical: Analysis of the larval series of 12 species belonging to the above families

11 September and 25 September (Day 6)

Theoretical: Distinctive characters for identification of the eggs and/or larvae of: Carangidae, Sciaenidae and Labridae E.H. AHLSTROM

Practical: Analysis of the larval series of 12 species belonging to the above families

12 September and 26 September (Day 7)

Theoretical: Review of distinctive characters of the larvae of various families of Perciformes: Bramidae, Branchiostegidae, Coryphaenidae, Kyphosidae, Pomacentridae, Pomatomidae, Sparidae, Sphyraenidae, Stromateidae E.H. AHLSTROM

Practical: Analysis of the larval series of 12 species belonging to the above families

13 September and 27 September (Day 8)

Theoretical: Distinctive characters for identification of larvae of Synodontidae, Exocoetidae, eel Leptocephali, Gobiidae, Atherinidae and Serranidae — E.H. AHLSTROM

Practical: Analysis of the larval series of 12 species belonging to the above families

14 September and 28 September (Day 9)

Theoretical: Summary lecture reviewing different developmental patterns exemplified during the course and evaluation of characters used in identification of fish eggs and larvae — E.H. AHLSTROM

Practical: General examination of the identification of mixed samples of the larval series studied during the Course

Appendix 3

FACILITIES AVAILABLE FOR PRACTICAL WORK

In the laboratory

(a) Reference collection of 96 larval series of fish species

(b) Binocular microscopes (10)

(c) Slides, dishes, forceps, dissecting needles, etc.

(d) Collecting jars, labels, preserving liquid

(e) Plankton splitters

(f) Calculators

(g) Pencils, paper, graph paper (various types)

On board R/V DAVID STARR JORDAN

The following additional equipment for plankton sampling was available:

(a) Bongo assembly with aluminium frame, fitted with nets of 0.505 and 0.333 mm mesh size

(b) One metre CalCOFI net

(c) CalCOFI Neuston net (non-quantitative)

(d) Isaacs-Kidd Midwater Trawl, MARMAP, 6 in, 2 mm mesh

(e) Digital and TSK flow meters

(f) Depth-time recorder ("Benthos" Manif.)

Appendix 4

LIST OF INSTRUCTION MATERIAL PROVIDED TO EACH TRAINEE

1. Reference books and reports

UNESCO Monography on Zooplankton sampling (1968)

FAO Contributions to a Manual on Fish Egg and Larval Survey. FAO Fish.Tech.Pap., 122 (1973)

Collecting and Processing Data on Fish Eggs and Larvae in the California Current Region, by D. Kramer et al., NOAA Tech.Rep.NMFS Circ., 370 (1972)

2. Reprints of Scientific Papers

2.1 Identification (See also Section 3.2)

Ahlstrom, E.H., 1971 Remarkable movements of oil globules in eggs of bathylagid smelts during embryonic development. J.Mar.Biol.Assoc.India, 11(1/2):206-17

Ahlstrom, E.H. and P. Ball, 1954 Description of eggs and larvae of jack mackerel (Trachurus symmetricus) and distribution and abundance of larvae in 1950 and 1951. Fish. Bull.U.S.Fish.Wildl.Serv., 56:209-45

Ahlstrom, E.H. and R.C. Counts, 1955 Eggs and larvae of the Pacific hake Merluccius productus. Fish.Bull.U.S.Fish.Wildl.Serv., 56:295-329

_____, 1958 Development and distribution of Vinciguerria lucetia and related species in the eastern Pacific. Fish.Bull.U.S.Fish.Wildl.Serv., 58:363-416

Hollister, G., 1934 Cleaning and dyeing fish for bone study. Zoologica, 12(10):89-101

Kramer, D., 1960 Development of eggs and larvae of Pacific mackerel and distribution and and abundance of larvae 1952-56. Fish.Bull.U.S.Fish.Wildl.Serv., 60:393-438

Moser, H.G. and E.H. Ahlstrom, 1970 Development of Lanternfishes (Fam. Myctophidae) in the California Current, P.1, Species with narrow-eyed larvae. Bull.Los Angeles Cty.Mus.Nat.Hist.(Sci.), (7):1-145

_____, 1972 Development of the Lanternfish, Scopelopsis multipunctatus Brauer 1906, with a discussion of its phylogenetic position in the family Myctophidae and its role in a proposed mechanism for the evolution of photophore patterns in lanternfishes. Fish.Bull.NMFS/NOAA, 70(3):541-66

Taylor, W.R., 1967 An enzyme method of cleaning and staining small vertebrates. Proc.U.S.Nat. Mus., 122:1-17

2.2 Ichthyoplankton sampling for resources evaluation

Ahlstrom, E.H., 1959 Vertical distribution of pelagic fish eggs and larvae off California and Baja California. Fish.Bull.U.S.Fish.Wildl.Serv., 60:107-46

_____, 1959a Distribution and abundance of eggs of the Pacific sardine, 1952-1956. Fish. Bull.U.S.Fish.Wildl.Serv., 60:185-213

_____, 1961 Distribution and relative abundance of rockfish (Sebastodes spp.) off California and Baja California. Rapp.P.-V.Réun.Cons.Perm.Int.Explor.Mer., 150:169-76

Ahlstrom, E.H., Distribution and abundance of sardine and anchovy larvae in the California
1966 Current region off California and Baja California, 1951-64. A Summary. Spec. Sci.Rep.Fish.Wildl.Serv.(Fish.), (534):71 p.

_____, Co-occurrences of sardine and anchovy larvae in the California Current region
1967 off California and Baja California. Cal.Coop.Ocean.Fish.Invest., (11):117-35

_____, What might be gained from an oceanwide survey of fish eggs and larvae in
1968 various seasons. Cal.Coop.Ocean.Fish.Invest., (12):64-7

_____, Mesopelagic and bathypelagic fishes in the California Current region. Cal.
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Appendix 5

EXCURSIONS AND OTHER GROUP ACTIVITIES

- Saturday, 8 September

  Morning - Visit to San Diego Zoo in Balboa Park

  Afternoon - visit to Sea World

- Saturday, 15 September

  Excursion to San Diego Wild Animal Park

  Dr. Carl Hubbs, Professor Emeritus at Scripps Institution of Oceanography arranged for the group to have free admission to the above places. Transportation was kindly arranged by the Director and Co-Director of the Course

- Saturday, 8 September

  Evening - At Dr. Ahlstrom's home

- Sunday, 16 September

  Center Activities Club evening party

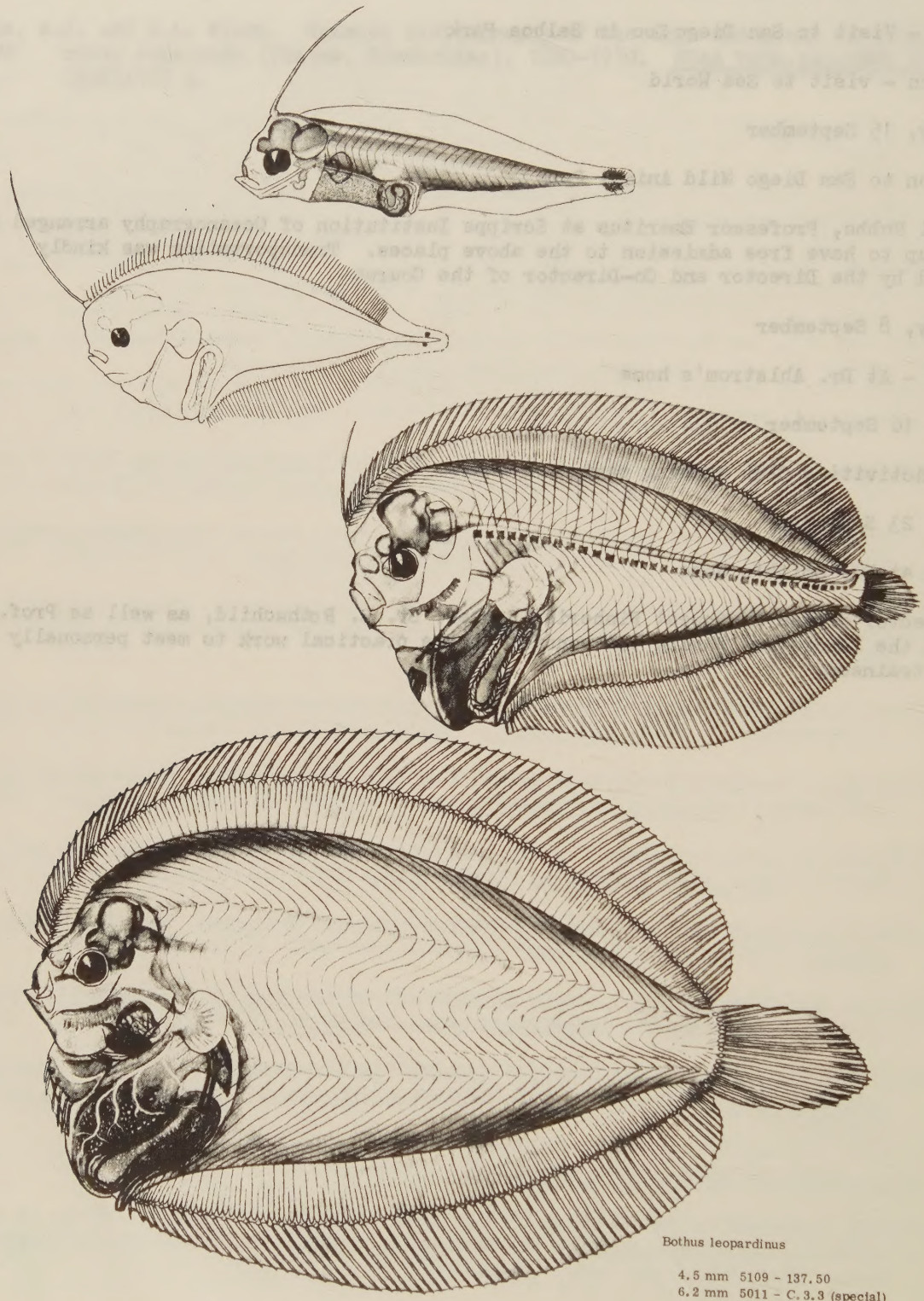
- Sunday, 23 September

  Evening at Dr. Smith's home

  The Director of the Southwest Fisheries Center, Dr. B. Rothschild, as well as Prof. C. Hubbs visited the laboratory during the conduct of the practical work to meet personally each one of the trainees.

Appendix 6

EXAMPLE OF ORIGINAL UNPUBLISHED ILLUSTRATIONS USED FOR PRACTICAL TRAINING IN IDENTIFICATION



Bothus leopardinus

4.5 mm 5109 - 137.50
6.2 mm 5011 - C.3.3 (special)
8.0 5106 - 157.10 deep
27.1 mm 5202 - 137.40

MR/E7709/E/3.74/1/750